Space Weather Technical Forecast

Issued on Tuesday 12 November 2024 at 01:16 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate solar activity is likely, with a slight chance of X-class flares. Chance of G1/Minor Geomagnetic Storm intervals from 13 Nov.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate with two M-class flares observed during the period. The largest was an M1.4 flare at 11/0543 UTC from AR3889 in the southeast. There are currently six sunspot regions on the visible disc. AR3889, in the southeast, is the largest and most complex region. It contains a number of mature spots with at least two delta spots, although one in the trailing region appears to be weakening. This region has seen minor growth in its leading portion, with small spots emerging ahead of its large mature spot. AR3883, in the southwest, has mature leading and trailing spots, and has seen some recent decay of its smaller spots within its intermediate portion. The remaining spot regions are stable and magnetically simple.

No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE and DSCOVR were indicative of ongoing enhancement following likely CH HSS influence. Wind speeds were generally slightly elevated throughout, peaking around 450km/s, before gradually declining to background levels, just below 400km/s. Density was below average. The Interplanetary Magnetic Field (IMF), Bt, was Weak, peaking at 7nT. The north-south component, Bz, was mostly southward (negative) directed at Weak levels with a maximum southward deflection of -5nT. Phi angle was predominantly positive (away from the Sun) throughout. The resultant geomagnetic Activity was generally Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels throughout. The associated 24-hour fluence was well below the Active threshold, with 8.2e6 integrated flux observed at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is forecast to continue, with a likelihood of isolated M-class flares and a slight chance of X-class flares, these probably from AR3889.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. HSS influences are expected through this period, initially from CH88/+ in the southwest and later from

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the large CH90/+ currently moving into the western hemisphere. Solar winds are expected to be at background levels on Day 1 (12 Nov), before becoming elevated again with a possible connection to CH90/+ from Day 2 (13 Nov).

Generally Quiet to Unsettled (Kp1-3) activity is forecast for Day 1 (12 Nov) as coronal hole influence eases. More Unsettled to Active (Kp3-4) conditions then expected from Day 2 (13 Nov) due to a HSS from CH90/+, with a slight chance of G1/Minor Geomagnetic Storm intervals (Kp5) during the remainder of the period.

Energetic Particles / Solar Radiation: High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms later in the period, mainly due to any significant flares from AR3889 as it rotates into a more geoeffective position in the western hemisphere. The high energy electron flux is expected to remain at generally Background to Moderate levels. The associated fluence is excepted to persist below Active levels.

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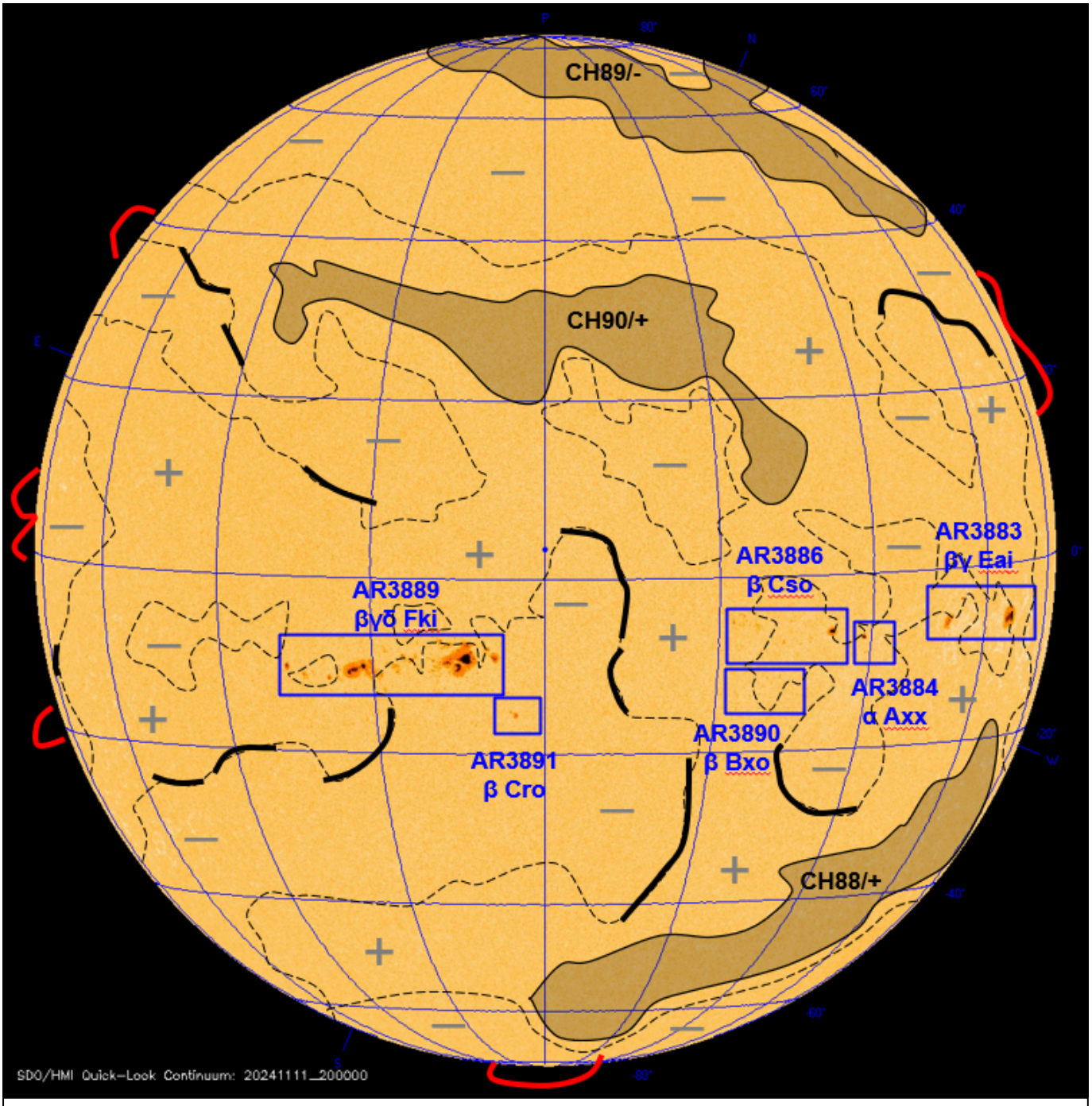
Figure 1: Solar Synoptic Map valid 11/2000UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No Earth-directed CMEs are currently forecast. A CME was observed off the western limb in association with a C8.4 flare at 10/2253UTC, but is expected to pass comfortably ahead of Earth. A filament eruption was also observed in the northeastern quadrant around 11/0100UTC, with a faint narrow CME observed in coronagraph imagery. Initial analysis suggests this is passing behind Earth's orbit.

A large filament eruption seen lifting off the southern hemisphere at 11/1550 UTC produced a CME, which was observed in both LASCO C2/C3 and STEREO-A. This is currently under going analysis for any Earth-directed component. However, it looks like this feature is mostly heading southwards away from the Earth-Sun line, therefore, not anticipating any impacts from this event.

Solar winds have been recently enhanced due to either weak transient arrivals, or more likely coronal hole HSS influences from CH88/+ in the southwest. Solar winds have been slightly elevated between 400-450km/s, although have now declined to background levels, and are expected to remain so during Day 1 (12 Nov) in the absence of further enhancement. Another enhancement is likely from CH90/+ which is currently moving into the western hemisphere. This feature was present on previous rotation, although appeared to smaller in appearance compared to this rotation. Solar winds reached up to 450-500km/s on previous rotation, which is also expected on this rotation, based on persistence from Day 2 (13 Nov). MOSWOC Enlil is providing reasonable guidance for the start of the period, however it doesn't have any connection to CH90/+ signalled, and as such confidence in Enlil is low through the period.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp1-3) on Day 1 (12 Nov) as coronal hole influence eases. Unsettled to Active (Kp3-4) conditions are expected from Day 2 (13 Nov) due to a HSS from CH90/+, with a slight chance of G1/Minor Geomagnetic Storm intervals (Kp5) during the remainder of the period.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	20	30	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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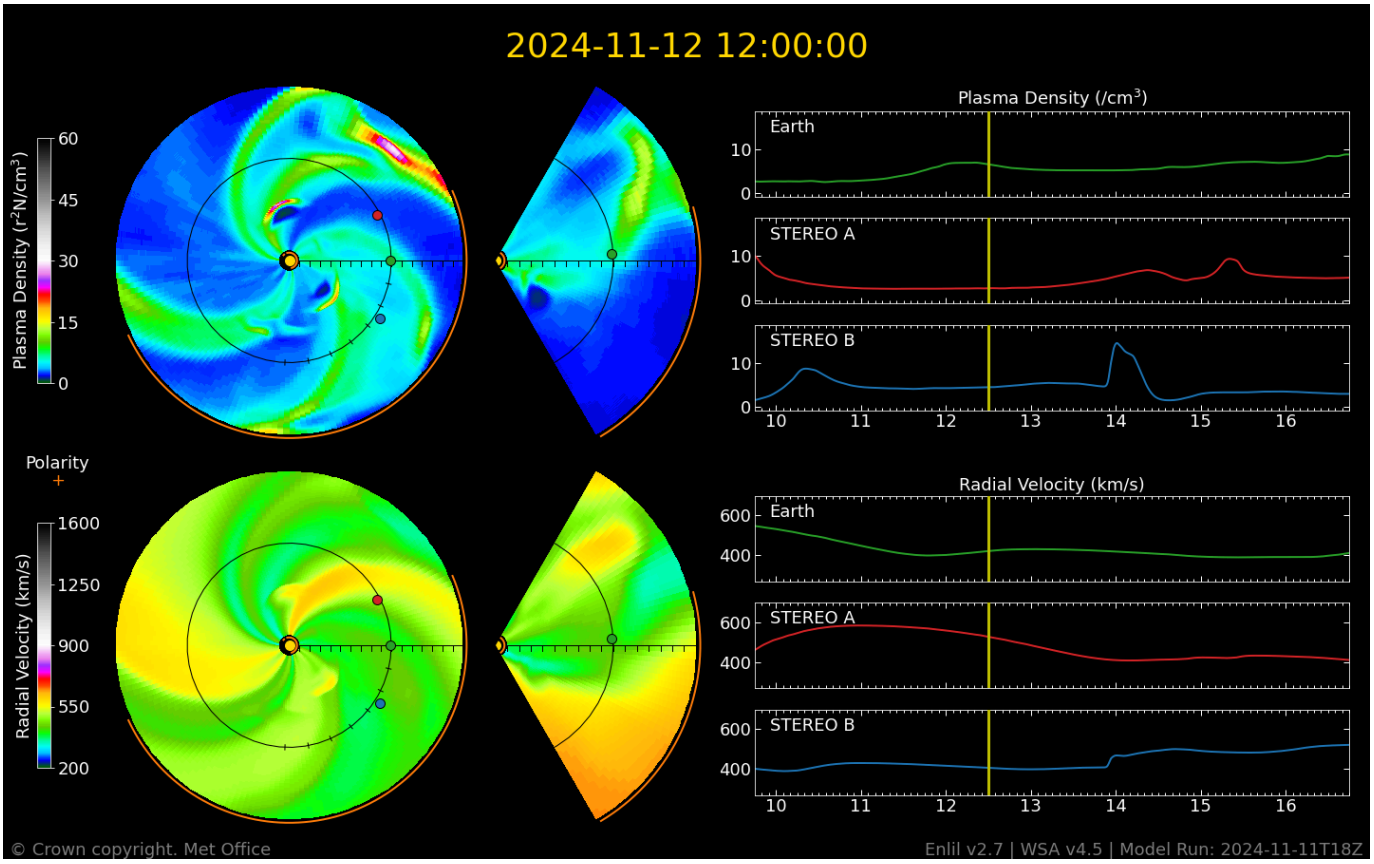
Figure 2: MOSWOC Enlil model. Note the absence of any connection to CH90/+ later in the period.



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Radio Blackouts - X-Ray Flares

Solar activity was Moderate during the period with two M-class flares originating from AR3889 in the southeast. The largest was an M1.4 flare at 11/0543 UTC. There are six sunspot regions on the visible disc. AR3889, in the southeast, is the largest and most complex region. It contains a number of mature spots with at least two delta regions, although one in the trailing region appears to be weakening. This region has seen minor growth in its leading portion, with small spots emerging ahead of the large mature spot. AR3883, in the southwest, has mature leading and trailing spots, and has seen some recent decay of its smaller spots within its intermediate portion. The remaining spot regions are stable and magnetically simple.

Moderate activity is forecast to continue, with a likelihood of isolated M-class flares and a slight chance of X-class flares, these probably from AR3889.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	Yes	70	70	70	70
Very Active	R3-R5 (X Class)	No	20	20	20	20

Figure 3: GOES18 X-Ray Flux

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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms later in the period, mainly due to any significant flares from AR3889 as it rotates into a more geoeffective position in the western hemisphere.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	15	20	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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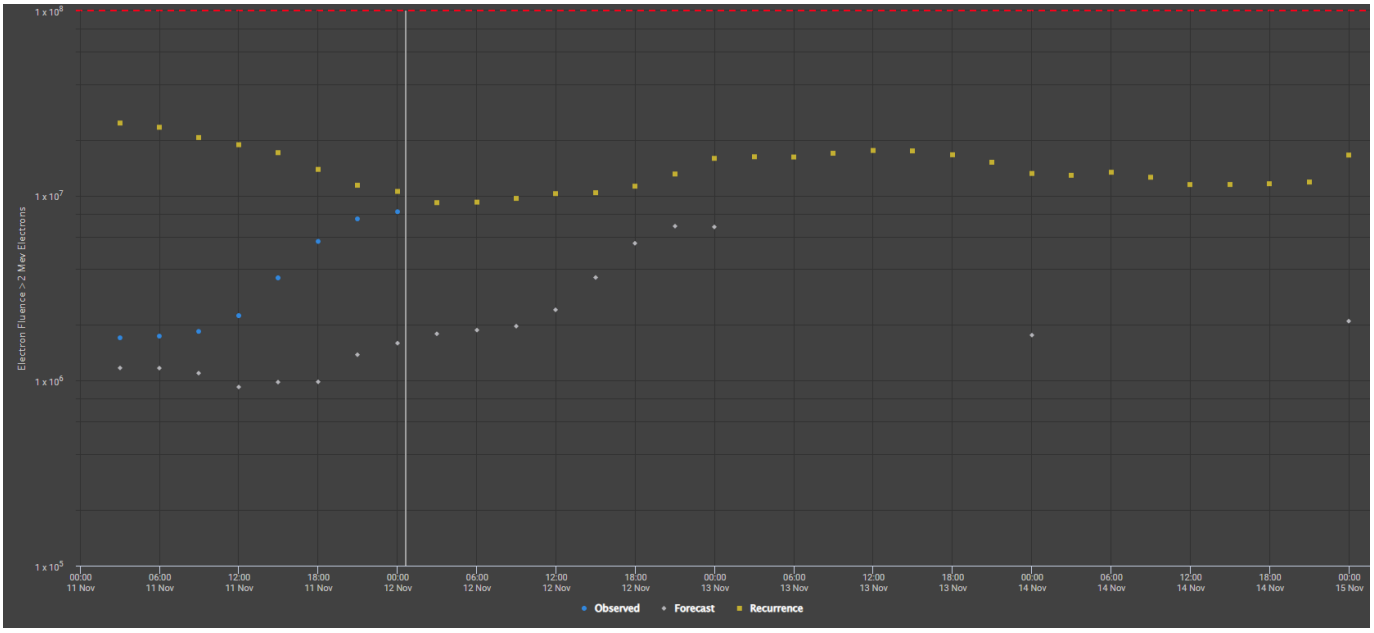
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is at Background levels.

The high energy electron flux is expected to remain at generally Background to Moderate levels, potentially increasing to brief High levels at diurnal peak early in the period. The associated 24 hour fluence is expected to remain below Active levels aligning with the MOSWOC REFM output, which appears to provide reliable guidance.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: MOSWOC Electron fluence



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